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**DESCRIPTION**

A CHANNEL STRUCTURING METHOD AND BASE  
STATION THEREWITH

5 **TECHNICAL FIELD**

The present invention relates to a channel  
structuring method and a base station using such a  
method. The present invention particularly relates  
to a channel structuring method for a downlink  
10 channel between a base station and mobile stations,  
and relates to the base station using such a method.

**BACKGROUND TECHNOLOGY**

Generally, a mobile communication system  
15 is operated under a multipath environment where  
radio wave reaches a reception side through various  
propagation paths. Under such a multipath  
environment, a signal that arrives later interferes  
with a signal of the present, producing  
20 characteristic degradation which is called inter-  
symbol interference.

However, a transmission method that  
employs an orthogonal frequency division  
multiplexing (called the OFDM hereinafter,  
25 Orthogonal Frequency Division Multiplexing) as a  
modulation method can realize a high-speed  
transmission, without causing characteristic  
degradation by the inter-symbol interference, even  
if it is under a multipath environment.

30 This is because the influence of the  
inter-symbol interference is alleviated by long  
symbols used by the OFDM transmission in which a  
wideband signal is segmented and transmitted in

parallel using a plurality of subcarriers that are orthogonal to each other. Against this background, studies have been made on mobile communication systems that use the OFDM as the modulation method.

5           As an example of a mobile communication system that uses the OFDM as the modulation method, "Performance of an OFDM-TDMA Mobile Communication System" (1593 H. Rohling, R.Grunheid:Proc.of IEEE VTC 1996, and vol. 3, pp.1589-1996), for example,  
10       uses the OFDM as the modulation method for the signal transmission and examines the time division multiple access (TDMA herein below, Time Division Multiple Access:) for communication between a base station and each mobile station.

15           In this study, it is shown that communication quality will be enhanced by adaptively assigning signals transmitted to mobile stations to subcarriers according to subcarrier reception conditions at the mobile station, utilizing the  
20       characteristics of the OFDM that conducts a transmission with a plurality of subcarriers.

          Further, a similar study has been made in "Performance Comparison of Different Multiple Access Methods Schemes for the Downlink of an OFDM  
25       Communication System" (Proc.of IEEE VTC 1997 pp.1365-1369, 1997).

          In this study, an example of a frame structuring that takes synchronization signal, control signal, and information signal into  
30       consideration is shown for application to an OFDM transmission between the base station and the mobile station.

          Further, the mobile communication system

experiences a phenomenon called fading that is caused by changes in the relative position of the base station and the mobile station, which affects received signals with amplitude fluctuation and  
5 phase fluctuation. Therefore, in order to receive a signal transmitted in the mobile communication system by a coherent detection, it is necessary to estimate the amplitude fluctuation and the phase fluctuation accurately to compensate the  
10 fluctuations of the received signal using the estimated values for demodulation.

In order to estimate the amplitude fluctuation and the phase fluctuation of the received signal, there is a method wherein a pilot  
15 symbol with known amplitude and phase is multiplexed with a transmission signal and transmitted, which is used to estimate the amplitude fluctuation and the phase fluctuation of the received signal on the receiving end. In the mobile communication system  
20 which uses the OFDM as the modulation method, the channel estimation using the pilot symbol is also necessary in order to perform the coherent detection, and various studies have been made.

In "Robust Channel Estimation for OFDM  
25 System with Rapid Dispersive Fading Channels" (Y. Li, L.J.Cimini, N.R.Sollenberger.IEEE Transactions on Communications, vol.46, no.7, July 1998), for example, a method using a combination of the channel estimation in the time domain and the channel  
30 estimation in the frequency domain is shown.

Further, in "Performance Analysis of an OFDM System Using Data-Aided Channel Estimation" (V. Kaasila:Proc.of IEEE VTC 1999, pp.2303-2307), a

study is made as to a time interval at which the pilot symbol should be multiplexed and how much pilot symbol should be used to estimate the channel fluctuation.

5                   However, the various studies mentioned above are concerned with a proposal and an evaluation of the methods for mainly enhancing transmission quality. In order for a mobile communication system to use an OFDM/TDM (Time  
10 Division Multiplex) transmission method for a downlink actually, it is necessary to consider a structuring method of the common control channel for transmitting a control signal between the base station and the mobile station.

15                   Especially, it is necessary to consider use of the channel of not only in the time domain but also in the frequency domain, because the parallel transmission by two or more subcarriers is performed when the OFDM is used as the modulation  
20 method.

                  Furthermore, the studies concerning the pilot symbol insertion have been performed about how much amount of pilot symbol is required, and how the pilot symbols should be inserted only from the point  
25 of the measure to a physical fading phenomenon in an environment of one transmitter and one receiver.

#### **DISCLOSURE OF INVENTION**

                  Therefore, the general purpose of the  
30 present invention is to provide a new and useful channel structuring method having removed the problems of the conventional technology mentioned above, and a base station using the method.

The specific purpose of the present invention is to provide the channel structuring method which is capable of inserting the common control channel signal and the common pilot signal  
5 in the downlink channel between the base station and the mobile stations, and the base station using the method.

The purpose of the present invention mentioned above is achieved by a channel structuring  
10 method that includes a step of inserting the common control channel signal and the common pilot signal into  $n$  subcarriers in channel structuring methods that compose a downlink channel by modulating the transmission signal by an orthogonal frequency  
15 division multiplexing method which has  $n$  subcarriers, and multiplexing by a time division multiplex.

In the channel structuring method, the common control channel signal and the common pilot signal can be inserted into the downlink channel  
20 between the base station and the mobile station, thereby enabling to realize a channel structuring for transmitting the common control signal between the base station and the mobile station. Further, the insertion of the common pilot signal into the  
25 downlink channel makes a countermeasure to the fading phenomenon possible.

The above-mentioned channel structuring method can include a step wherein time frames that are segmented at a predetermined time interval in a  
30 communication channel of the  $n$  subcarriers mentioned above are provided, and a step wherein a predetermined number of subcarriers are selected from the  $n$  subcarriers mentioned above and the

common control channel signal and the common pilot signal are inserted periodically into each of the time frames of the selected subcarriers.

In such a channel structuring method, a  
5 predetermined number of subcarriers are selected from the  $n$  subcarriers, and the common control channel signal and the common pilot signal are inserted into each time frame of the selected subcarriers. The common control channel signal and  
10 the common pilot signal can be inserted periodically.

In the above-mentioned channel structuring method, the common control channel signal and the common pilot signal which are periodically inserted into each time frame of a subcarrier selected as  
15 mentioned above can be inserted such that either of the common control channel signal or the common pilot signal, or both may be inserted at the same timing as either of the common control channel signal or the common pilot signal of other  
20 subcarriers, or both.

Thus, by inserting the common control channel signal and the common pilot signal into the selected subcarrier at the same timing as the common control signal and the common pilot signal inserted  
25 periodically into each frame of the other subcarriers, control in a base station and a mobile station becomes easy.

In the above-mentioned channel structuring method, a step of setting up time frames segmented  
30 at every predetermined interval in the communication channel of the  $n$  subcarriers mentioned above, a step of selecting a predetermined number of subcarriers from the  $n$  subcarriers mentioned above and

continuously inserting the common control channel  
signal into the time frames of the selected  
subcarrier mentioned above, and a step of selecting  
a predetermined number of subcarriers from the n  
5 subcarriers mentioned above and periodically  
inserting the common pilot signal into each of the  
time frames of the selected subcarrier mentioned  
above may be provided.

In such a channel structuring method, the  
10 common control channel signal may be continuously  
inserted into the time frame of the selected  
subcarrier, and the common pilot signal can be  
periodically inserted for each time frame of the  
selected subcarrier.

15 In the above-mentioned channel structuring  
method, a step of setting up time frames segmented  
at every predetermined interval in the communication  
channel of the n subcarriers mentioned above, a step  
of selecting a predetermined number of subcarriers  
20 from the n subcarriers mentioned above and  
continuously inserting the common pilot signal into  
the time frames of the selected subcarriers  
mentioned above, and a step of selecting a  
predetermined number of subcarriers from the n  
25 subcarriers mentioned above and periodically  
inserting the common control channel signal into  
each of the time frames of the selected subcarriers  
mentioned above may be provided.

According to such a channel structuring  
30 method, the common pilot signal can be continuously  
inserted into the time frame of the selected  
subcarriers, and the common control channel signal  
can be periodically inserted for each time frame of

the selected subcarrier.

In the channel structuring method mentioned above, subcarriers into which the above-mentioned common control channel signal is inserted  
5 may be the same completely or partially as subcarriers into which the common pilot signal is inserted.

According to such a channel structuring method, the common pilot signal can be inserted into  
10 the subcarrier into which the common control channel signal is continuously inserted, or the common control channel signal can be inserted into the subcarrier into which the common pilot signal is continuously inserted.

15 The above-mentioned channel structuring method may include a step of setting up the time frames segmented at each predetermined interval in a communication channel of the  $n$  subcarriers mentioned above, a step of selecting a predetermined number of  
20 subcarriers from the  $n$  subcarriers mentioned above and inserting the common control channel signal continuously into the time frames of the selected subcarriers mentioned above, and a step of selecting a predetermined number of subcarriers from the  $n$   
25 subcarriers mentioned above and inserting the common pilot signal continuously into the time frames of the selected subcarriers mentioned above.

According to such a channel structuring method, each of the common control channel signal  
30 and the common pilot signal can be continuously inserted into the time frames of the selected subcarriers.

Further, the task of the present invention

is achieved by a base station that includes common control channel signal insertion means for inserting the common control channel signal into all or part of the n subcarriers mentioned above and common pilot signal insertion means for inserting the common pilot signal into all or part of the n subcarriers mentioned above, among base stations that compose downlink channels by modulating transmission signals by the orthogonal frequency division multiplexing method using n subcarriers and by multiplexing by the time division multiplex.

Such a base station can insert the common control channel signal and the common pilot signal into the downlink channel. That is, the channel structuring for transmitting a common control signal between the base station and the mobile stations is realizable. Further, inserting the common pilot signal into the downlink channel makes the measure to a fading phenomenon possible.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Other purposes, features, and advantages of the present invention will become clearer by reading following descriptions, with reference to attached drawings.

Fig. 1 is a block diagram of an example of equipment which realizes the channel structuring method in the present invention.

Fig. 2 is a channel structuring drawing of the first implementation of the channel structuring method in the present invention.

Fig. 3 is a channel structuring drawing of the second implementation of the channel structuring

method in the present invention.

Fig. 4 is a channel structuring drawing of the third implementation of the channel structuring method in the present invention.

5 Fig. 5 is a channel structuring drawing of the fourth implementation of the channel structuring method in the present invention.

Fig. 6 is a channel structuring drawing of the fifth implementation of the channel structuring method in the present invention.

Fig. 7 is a channel structuring drawing of the sixth implementation of the channel structuring method in the present invention.

Fig. 8 is a channel structuring drawing of the seventh implementation of the channel structuring method in the present invention.

Fig. 9 is a channel structuring drawing of the eighth implementation of the channel structuring method in the present invention.

20 Fig. 10 is a channel structuring drawing of the ninth implementation of the channel structuring method in the present invention.

Fig. 11 is a channel structuring drawing of the 10th implementation of the channel structuring method in the present invention.

Fig. 12 is a channel structuring drawing of the 11th implementation of the channel structuring method in the present invention.

Fig. 13 is a channel structuring drawing of the 12th implementation of the channel structuring method in the present invention.

Fig. 14 is a channel structuring drawing of the 13th implementation of the channel

structuring method in the present invention.

#### **BEST MODE IMPLEMENTATIONS OF THE PRESENT INVENTION**

Hereafter, implementations of the present  
5 invention are described based on the drawings.

Fig. 1 is a block diagram of an example of  
equipment which realizes the channel structuring  
method in the present invention. In Fig.1,  
information sources 1a through 1n output information  
10 signals to be transmitted to mobile stations from a  
base station, such as voice and data. The  
information signals outputted from the information  
sources 1a through 1n are supplied to a time  
division multiplexing (TDM) unit 3 after being  
15 modulated by modulation units 2a through 2n. The  
time division multiplex unit 3 carries out time  
division multiplexing of the modulated information  
signals. The common pilot signal provided from the  
common pilot signal insertion unit 6 is inserted  
20 into the time multiplexed signal at an adder 4, and  
the common control channel signal provided from a  
common control channel insertion unit 7 is inserted  
at an adder 5.

Here, the common control channel includes  
25 an information channel and an accompanying control  
channel which are generally used in mobile  
communication systems. The signal into which the  
common pilot signal and the common control channel  
signal have been inserted in the adder 4 and the  
30 adder 5 is supplied to an OFDM modulation unit 8.

The OFDM modulation unit 8 carries out an  
OFDM modulation of the supplied signal, and outputs  
the transmission signal which has a channel

structuring that will be described later. In addition, the common pilot signal and the common control channel signal can be time-multiplexed by changing an assignment of subcarriers at every time  
5 interval and frequency-multiplexed by changing an assignment of the signal for each subcarrier.

Hereafter, the channel structuring of the transmission signal will be described with reference to the drawings. Fig. 2 shows the channel  
10 structuring of the first implementation of the channel structuring method in the present invention. In the following, an OFDM method with subcarriers 1 through  $n$  ( $n$  : natural number) will be described.

In Fig. 2, the common control channel  
15 signal and the common pilot signal are inserted into the communication channel of each of the subcarriers 1 through  $n$  by time multiplexing. Specifically, the common control channel signal and the common pilot signal are inserted into insertion positions SC 1-1,  
20 SC1-2 and the like as shown in Fig. 2.

Additionally, into the insertion positions SC1-1 and the like, only the common control channel signal, only the common pilot signal or both of the common control channel signal and the common pilot  
25 signal may be inserted. Further, any method may be used for inserting the common control channel signal and the common pilot signal into the insertion position SC1-1 and the like of the communication channel of each of the subcarriers 1 through  $n$  by  
30 the time multiplexing.

Fig. 3 shows the channel structuring of the second implementation of the channel structuring method in the present invention. In Fig. 3,

subcarriers 10, 11, and 12 are selected into which the common control channel signal and the common pilot signal will be inserted, and the common control channel signal and the common pilot signal are frequency-multiplexed using the selected subcarriers 10, 11, and 12.

In addition, the selected subcarrier 10 and the like may include only the common control channel signal, only the common pilot signal, or the both of the common control channel signal and the common pilot signal. Further, any method may be used for inserting the common control channel signal and the common pilot signal into the selected subcarrier 10 and the like by the frequency multiplexing.

Fig. 4 shows the channel structuring of the third implementation of the channel structuring method in the present invention. In Fig.4, the time frames segmented at every constant interval are provided in the communication channel of the  $n$  subcarriers 1 through  $n$ .

First, any  $k$  pieces ( $k$  : natural number,  $k \leq n$ ) of the subcarriers are selected from  $n$  subcarriers 1 through  $n$ , and the common control channel signal is periodically inserted into every time frame. Further, any  $l$  pieces ( $l$  : natural number,  $l \leq n$ ) of the subcarriers are selected out from  $n$  subcarriers 1 through  $n$ , and the common pilot signal is periodically inserted into every time frame.

For example, the common control channel signal is inserted into the insertion positions SC 1-1 and SC 1-3 of the subcarrier 1. Further, the common pilot signal is inserted into the insertion

positions SC 1-2 and SC 1-4 of the subcarrier 1. Further, the insertion positions of the common control channel signal and the common pilot signal are different in timing for each subcarrier.

5           In addition, the relative insertion position and time length within a time frame for the common control channel signal and the common pilot signal can be any insertion position and time length.

10           Fig. 5 shows the channel structuring of the fourth implementation of the channel structuring method in the present invention. In the channel structuring drawing of Fig. 5, providing time frames in the communication channel of the n subcarriers 1 through n, and selecting an arbitrary number of  
15           subcarriers from n subcarriers 1 through n and inserting the common control channel signal and the common pilot signal are similar to the third implementation, and descriptions thereof are omitted where they are identical.

20           Here, the channel structuring of the fourth implementation of the present invention is characterized by the insertion position of the common control channel signal that has the same timing for every subcarrier. However, the insertion  
25           position of the common pilot signal is selected at different timing for every subcarrier.

          For example, the common control channel signal is inserted into the insertion position SC 1-1 of the subcarrier 1, and the insertion position SC  
30           2-1 of the subcarrier 2. Further, the common pilot signal is inserted into the insertion position SC 1-2 of the subcarrier 1, and the insertion position SC 2-2 of the subcarrier 2.

In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the common control channel signal and the common pilot signal within a time frame.

Fig. 6 shows the channel structuring of the fifth implementation of the channel structuring method in the present invention. In the channel structuring drawing of Fig. 6, providing time frames in the communication channel of the  $n$  subcarriers 1 through  $n$ , and selecting an arbitrary number of subcarriers from  $n$  subcarriers 1 through  $n$  and inserting the common control channel signal and the common pilot signal are similar to the third implementation, and descriptions thereof are omitted where they are identical.

Here, the channel structuring of the fifth implementation of the present invention is characterized by the insertion position of the common pilot signal that has the same timing for every subcarrier. However, the insertion position of the common control channel signal is chosen at different timing for every subcarrier.

For example, the common control channel signal is inserted into the insertion position SC 1-1 of the subcarrier 1, and the insertion position SC 2-1 of the subcarrier 2. Further, the common pilot signal is inserted into the insertion position SC 1-2 of the subcarrier 1, and the insertion position SC 2-2 of the subcarrier 2.

In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the common

control channel signal and the common pilot signal within a time frame.

Fig. 7 shows the channel structuring of the sixth implementation of the channel structuring method in the present invention. In the channel structuring drawing of Fig. 7, providing time frames in the communication channel of the  $n$  subcarriers 1 through  $n$ , and selecting an arbitrary number of subcarriers from  $n$  subcarriers 1 through  $n$  and inserting the common control channel signal and the common pilot signal are similar to the third implementation, and descriptions thereof are omitted where they are identical.

Here, the channel structuring of the sixth implementation of the present invention is characterized by the insertion position of the common control channel signal and the common pilot signal that have the same timing for every subcarrier.

For example, the common control channel signal is inserted into the insertion position SC 1-1 of the subcarrier 1, and the insertion position SC 2-1 of the subcarrier 2. Further, the common pilot signal is inserted into the insertion position SC 1-2 of the subcarrier 1, and the insertion position SC 2-2 of the subcarrier 2.

In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the common control channel signal and the common pilot signal within a time frame.

Fig. 8 shows the channel structuring of the seventh implementation of the channel

structuring method in the present invention. In Fig. 8, the time frames segmented at every fixed interval in the communication channel of  $n$  subcarriers 1 through  $n$  are provided.

5 First, arbitrary  $k$  pieces ( $k$  : natural number,  $k \leq n$ ) of the subcarriers are selected from  $n$  subcarriers 1 through  $n$ , and a pair of the common control channel signal and the common pilot signal is periodically inserted into each of the time  
10 frames.

For example, the pair of the common control channel signal and the common pilot signal is inserted into the insertion positions SC 1-1 and SC 1-2 of the subcarrier 1. Further, the insertion  
15 position of the pair of the common control channel signal and the common pilot signal is chosen at different timing for every subcarrier, like the insertion position SC 1-1 of the subcarrier 1, and the insertion position SC 2-1 of the subcarrier 2.

20 In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the pair of the common control channel signal and the common pilot signal within a time frame.

25 Fig. 9 shows the channel structuring of the eighth implementation of the channel structuring method in the present invention. In the channel structuring drawing of Fig. 9, providing time frames in the communication channel of the  $n$  subcarriers 1  
30 through  $n$ , and selecting an arbitrary number of subcarriers from  $n$  subcarriers 1 through  $n$  and inserting the common control channel signal and the common pilot signal are similar to the third

implementation, and descriptions thereof are omitted where they are identical.

Here, the channel structuring of the eighth implementation of the present invention is characterized by the insertion position of the pair of the common control channel signal and the common pilot signal that have the same timing for every subcarrier.

For example, the insertion position of the pair of the common control channel signal and the common pilot signal is chosen at the same timing for every subcarrier like the insertion position SC 1-1 of the subcarrier 1, and the insertion position SC 2-1 of the subcarrier 2.

In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the pair of the common control channel signal and the common pilot signal within a time frame.

Fig. 10 shows the channel structuring of the ninth implementation of the channel structuring method in the present invention. In Fig. 10, the time frames which are segmented at every fixed interval in the communication channel of  $n$  subcarriers 1 through  $n$  are provided.

First, arbitrary  $k$  pieces ( $k$  : natural number,  $k \leq n$ ) of the subcarriers are selected from  $n$  subcarriers 1 through  $n$ , and the common control channel signal is continuously inserted into the time frame of the selected subcarriers. For example, the common control channel signal is continuously inserted into the time frame of the selected subcarriers 1 and 3.

Further, arbitrary 1 piece ( $1 \leq n$ ) of the subcarriers are selected from the  $n$  subcarriers 1 through  $n$ , and the common pilot signal is periodically inserted into every time frame. For example, the common pilot signal is inserted into the insertion positions SC 2-1 and SC 4-1 of the selected subcarriers 2 and 4, respectively. In addition, the insertion position of the common pilot signal may be chosen at different timing, or the same timing for every subcarrier.

Here, the channel structuring of the ninth implementation of the present invention is characterized by the fact that a subcarrier into which the common control channel signal is inserted is different from a subcarrier into which the common pilot signal is inserted. In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the common pilot signal within a time frame.

Fig. 11 shows the channel structuring of the 10th implementation of the channel structuring method in the present invention. Here, providing time frames into the communication channels of the  $n$  subcarriers 1 through  $n$  and selecting arbitrary subcarriers from the  $n$  subcarriers 1 through  $n$ , and inserting the common control channel signal and the common pilot signal are the same as in the ninth implementation. And therefore, descriptions are omitted where they are identical.

Here, channel structuring of the 10th implementation of the present invention is characterized by the fact that a subcarrier into which the common control channel signal is inserted

and a subcarrier into which the common pilot signal is inserted are partially overlapping.

For example, when the common control channel signal is continuously inserted into the time frames of the subcarrier 1, the insertion position SC 1-1 is assigned for the common pilot signal to be inserted. Consequently, as for the subcarrier 1, the common pilot signal is inserted into the insertion position SC 1-1, and the common control channel signal is continuously inserted into time frames other than the insertion position SC1-1 for the common pilot signal.

In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the common pilot signal within a time frame.

Fig. 12 shows the channel structuring of the 11th implementation of the channel structuring method in the present invention. In Fig. 12, the time frames segmented at a fixed interval are set up in the communication channel of the  $n$  subcarriers 1 through  $n$ .

First,  $k$  pieces ( $k$  : natural number,  $k \leq n$ ) of the arbitrary subcarriers are selected from the  $n$  subcarriers 1 through  $n$ , and the common control channel signal is periodically inserted into every time frame. For example, the common control channel signal is inserted into the insertion position SC 2-1 and SC 4-1 of the selected subcarriers 2 and 4, respectively. In addition, the insertion position of the common control channel signal is chosen either at a different timing or the same timing for every subcarrier.

Further,  $l$  pieces ( $l$  : natural number,  $1 \leq l \leq n$ ) of the arbitrary subcarriers are selected from the  $n$  subcarriers 1 through  $n$ , and the common pilot signal is continuously inserted into the time frame of the selected subcarriers. For example, the common pilot signal is continuously inserted into the time frame of the selected subcarriers 1 and 3.

Here, channel structuring of the 11th implementation of the present invention is characterized by the fact that a subcarrier into which the common control channel signal is inserted differs from a subcarrier into which the common pilot signal is inserted. In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the common control channel signal within a time frame.

Fig. 13 shows the channel structuring of the 12th implementation of the channel structuring method in the present invention. In the channel structuring drawing of Fig. 9, providing time frames in the communication channel of the  $n$  subcarriers 1 through  $n$ , and selecting an arbitrary number of subcarriers from  $n$  subcarriers 1 through  $n$  and inserting the common control channel signal and the common pilot signal are similar to the third implementation, and descriptions thereof are omitted where they are identical.

Here, channel structuring of the 12th implementation of the present invention is characterized by the fact that a subcarrier into which the common control channel signal is inserted and a subcarrier into which the common pilot signal

is inserted are partially overlapping.

For example, when the common pilot signal is continuously inserted into the time frames of the subcarrier 1, the insertion position SC 1-1 is  
5 assigned for the common control channel signal to be inserted. Consequently, the common control channel signal is inserted into the insertion position SC 1-1, and the common pilot signal is continuously inserted into the time frames of the subcarrier 1  
10 other than the common control channel signal insertion position SC1-1. In addition, arbitrary insertion positions and time length are possible for the relative insertion position and the time length of the common control channel signal within a time  
15 frame.

Fig. 14 shows the channel structuring of the 13th implementation of the channel structuring method in the present invention. In Fig. 14, the time frames segmented at a fixed interval are set up  
20 in the communication channel of the  $n$  subcarriers 1 through  $n$ .

First,  $k$  pieces ( $k$  : natural number,  $k \leq n$ ) of the arbitrary subcarriers are from the  $n$  subcarriers 1 through  $n$ , and the common control  
25 channel signal is continuously inserted into the time frames of the selected subcarriers. For example, the common control channel signal is continuously inserted into the time frames of the selected subcarriers 1 and 3.

30 Further,  $l$  pieces ( $l$  : natural number,  $l \leq n$ ) of the arbitrary subcarriers are selected from the  $n$  subcarriers 1 through  $n$ , and the common pilot signal is continuously inserted into the time frames

of the selected subcarriers. For example, the common pilot signal is continuously inserted into the time frames of the selected subcarriers 2 and 4.

Here, channel structuring of the 13th  
5 implementation of the present invention is characterized by the fact that the common control channel signal and the common pilot signal are continuously inserted into the selected subcarriers, respectively.

10 As mentioned above, the common control channel signal and the common pilot signal can be inserted into the downlink channel between the base station and the mobile stations of the OFDM/TDM transmission method by using the channel structuring  
15 in the first through the 13th implementations of the present invention

Therefore, the channel structuring method for inserting the common control channel signal and the common pilot signal into the downlink channel  
20 between the base station and the mobile stations, and the base station using the channel structuring method can be realized.

As described above, according to the present invention, the common control channel signal  
25 and the common pilot signal can be inserted into the downlink channel between the base station and the mobile stations, thereby realizing the transmission of the common control signal.

Therefore, the OFDM/TDM transmission  
30 method can be actually applied to a downlink in a mobile communication system.